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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the method of painting using a metallic paint and a clear coating by the three quart 2 baking method (3C2B) or a four quart 2 baking method (4C2B), and forming a metallic paint film.

[0002]

[Description of the Prior Art]About the method of painting by a two quart 1 baking method (2C2B) using a metallic paint and a clear coating, and forming a metallic paint film, it is already publicly known. In this method, the thickness of a metallic paint film is usually within the limits of 15-20 micrometers in many cases, in order to conceal a ground and to maintain smooth nature. However, in this thickness, the orientation of metallic pigment is in disorder within that coat, and it is easy to generate metal nonuniformity, and has a defect in which flip flop nature (F/F nature) is insufficient.

[0003]

[Means for Solving the Problem]This invention aimed at dissolution of the above-mentioned defect, wholeheartedly, via direct or a clear paint film, by being a thin film and painting a metallic paint below to concealment thickness further, found out that the purpose could be attained to the metallic painted surface, and completed this invention to it as a result of research.

[0004]Namely, after this invention paints and hardens a metallic paint (A), Furthermore a metallic paint (C) and a clear coating (D) are painted, and it is related with a metallic film formation method [this method (1)] being a metallic paint film which hardens both coats, and coating film thickness of a metallic paint (C) being 5-13 micrometers, and being below concealment thickness.

[0005]This invention paints a metallic paint (A) and a clear coating (B), After hardening both

coats, are a metallic paint film which paints a metallic paint (C) and a clear coating (D) further, and hardens both coats, and coating film thickness of a metallic paint (C) at 5-13 micrometers. And it is related with a metallic film formation method [this method (2)] being below concealment thickness.

[0006]Below, a metallic film formation method of this invention is explained concretely.

[0007]This method (1) : After painting and hardening a metallic paint (A), a metallic paint (C) and a clear coating (D) are painted further, A metallic film formation method being a metallic paint film which hardens both coats, and coating film thickness of a metallic paint (C) being 5-13 micrometers, and being below concealment thickness.

[0008]Metallic paints (A) are base resin, a cross linking agent, metallic pigment, and a wet coating containing a solvent, and form a coat with brightness. As base resin, an acrylic resin, polyester resin, alkyd resin, etc. which have cross-linking functional groups, such as a hydroxyl group, are raised, for example, and melamine resin, a polyisocyanate compound (block), etc. which can react to this functional group as a cross linking agent are raised. Percentage of base resin and a cross linking agent. Based on sum total solid content weight of both this ingredient, it is [ 65 to 80% of the former ] suitable, and 35 to 20% of within the limits is [ especially the latter especially ] suitable 50 to 10% 50 to 90%. As metallic pigment, metal powder, such as flake-like aluminum, stainless steel, and brass, is raised, for example. Within the limits of ten to 25 weight section is [ especially rate of a compounding ratio of these metallic pigment ] suitable five to 30 weight section per sum total solid content of base resin and cross linking agent 100 weight section. As a solvent, an organic solvent for the usual paints can use it conveniently. A metallic paint (A) can be made to contain suitably a color pigment, light interference nature paints, an extender, an antisetling agent, a catalyst, etc. further.

[0009]10 to 20 % of the weight is [ solid content content of a metallic paint at the time of paint (A) ] suitable, and 10-20 micrometers 5-25-micrometer are [ especially concealment thickness especially ] suitable five to 25% of the weight.

[0010]"Concealment thickness" in this invention is the minimum thickness (cured film) which paints the target paint to the monochrome checkered painted surface, spaces that coat, and cannot view monochrome pattern, and it means that concealment nature is excellent, so that this thickness becomes thin.

[0011]In this method (1), a metallic paint (A) can be painted to a coated object made from metal or a plastic in direct or primer, and the painted surface that paints an intermediate coat if needed further. As a coated object, outer plate parts, such as a car body and a home appliance, are raised, for example, These surfaces can use a known thing, respectively as primer with preferred carrying out chemical conversion by a known method beforehand, and an intermediate coat, and it is suitable to paint, after a metallic paint (A) hardens these coats.

[0012]Paint of a metallic paint (A) is performed by an air spray, airless spray, electrostatic

coating, etc., and although it is preferred that it is more than concealment thickness as for the thickness, even if it is less than it, if it is possible to conceal a ground by sum total thickness with a coat of the after-mentioned metallic paint (C), it will not interfere. concrete -- thickness of a metallic paint (A) -- a standard [ cured film ] -- 5-20 micrometers -- especially -- Within the limits of 5-15 micrometers is suitable.

[0013]By this method (1), after painting a metallic paint (A) and hardening the coat, to the painted surface, it is 5-13 micrometers (cured film) of thickness, and a metallic paint (C) is painted below by concealment thickness.

[0014]Metallic paints (C) are base resin, a cross linking agent, metallic pigment, and a wet coating containing a solvent, and what was illustrated with the above-mentioned metallic paint (A) as these ingredients can use them conveniently. Within the limits of ten to 25 weight section is [ especially rate of a compounding ratio of metallic pigment ] suitable five to 30 weight section per sum total solid content of base resin and cross linking agent 100 weight section. A metallic paint (C) can be made to contain suitably a color pigment, light interference nature paints, an extender, an antissettling agent, a catalyst, etc. further. 10 to 20 % of the weight is [ especially solid content content of a metallic paint at the time of paint (C) ] suitable five to 25% of the weight. Even if concealment thickness of a metallic paint (C) is thicker than a metallic paint (A) used by the painting process, it does not interfere, and 10-20 micrometers 5-25-micrometer are especially suitable on the basis of a cured film.

[0015]In this method (1), thickness paints a metallic paint (C) to the hardening painted surface of a metallic paint (A) by thickness below 5-13 micrometers (cured film) and concealment thickness. That is, it is required for thickness of a metallic paint (C) to be 8-11 micrometers (cured film) preferably, to space 5-13 micrometers of the coat, and to be able to view the metallic painted surface of a metallic paint (A). Metal nonuniformity occurs that it will be hard to acquire uniform thickness distribution if thickness of a metallic paint (C) becomes thinner than 5 micrometers, Since it will be easy to generate metal nonuniformity like the conventional two quart 1 baking method (2C1B) and F/F nature will moreover fall if F/F nature moreover falls and becomes being easy to generate if it becomes thicker than 13 micrometers more thickly than concealment thickness in metal nonuniformity, it is not desirable.

[0016]This method (1) is attained by hardening both coats, after painting and hardening a metallic paint (A) as it described above, painting a metallic paint (C) further and painting a clear coating (D).

[0017]A clear coating (D) is a wet coating containing base resin, a cross linking agent, and a solvent, and forms a colorless or colored transparent coating film. As base resin, an acrylic resin, polyester resin, alkyd resin, etc. which have cross-linking functional groups, such as a hydroxyl group, are raised, for example, and melamine resin, a polyisocyanate compound (block), etc. which can react to this functional group as a cross linking agent are raised.

Percentage of base resin and a cross linking agent. Based on sum total solid content weight of both this ingredient, it is [ 65 to 80% of the former ] suitable, and 35 to 20% of within the limits is [ especially the latter especially ] suitable 50 to 10% 50 to 90%. As a solvent, an organic solvent for the usual paints can use it conveniently. A clear coating (D) can be made to contain suitably a color pigment, light interference nature paints, an extender, an antisepting agent, a catalyst, etc. to such an extent that a transparent feeling of a coat is not checked. 40 to 50 % of the weight is [ especially solid content content of a clear coating at the time of paint (D) ] suitable 30 to 60% of the weight.

[0018]In this method (1), after painting and hardening a metallic paint (A), painting a metallic paint (C) further and painting a clear coating (D) to the painted surface which is not hardened [ this ], it is attained by hardening both coats by metallic paint (C) and a clear coating (D).

[0019]Paint of a clear coating (D) is performed by an air spray, airless spray, electrostatic coating, etc., and, as for especially the thickness, 20-60 micrometers of within the limits of 25-45 micrometers are suitable on the basis of a cured film. It is attained, when hardening is 120-160 °C and heats preferably 100-180 °C of both coats by metallic paint (C) and a clear coating (D) for 10 to 40 minutes, for example.

[0020]This method (2) : A metallic paint (A) and a clear coating (B) are painted, After hardening both coats, it is a metallic film formation method being a metallic paint film which paints a metallic paint (C) and a clear coating (D) further, and hardens both coats, and coating film thickness of a metallic paint (C) being 5-13 micrometers, and being below concealment thickness.

[0021]Except painting a clear coating (B), this method (2) can be performed according to this method (1), and what was explained by this method (1) can use it similarly as a metallic paint (A), a metallic paint (C), and a clear coating (D).

[0022]A clear coating (B) is a wet coating containing base resin, a cross linking agent, and a solvent, and forms a colorless or colored transparent coating film. As base resin, an acrylic resin, polyester resin, alkyd resin, etc. which have cross-linking functional groups, such as a hydroxyl group, are raised, for example, and melamine resin, a polyisocyanate compound (block), etc. which can react to this functional group as a cross linking agent are raised. Based on sum total solid content weight of both this ingredient, it is [ 65 to 80% of the former ] suitable, and 35 to 20% of within the limits is [ especially the latter especially ] suitable [ as for percentage of base resin and a cross linking agent ] 50 to 10% 50 to 90%. As a solvent, an organic solvent for the usual paints can use it conveniently. A clear coating (B) can be made to contain suitably a color pigment, light interference nature paints, an extender, an antisepting agent, a catalyst, etc. to such an extent that a transparent feeling of a coat is not checked. 40 to 50 % of the weight is [ especially solid content content of a clear coating at the time of paint (B) ] suitable 30 to 60% of the weight.

[0023]Like this method (1), it paints by primer to coated objects made from metal or a plastic, or these coated objects, and, as for this method (2), it paints a metallic paint (A) by an air spray, airless spray, electrostatic coating, etc. to the painted surface which paints an intermediate coat if needed further. Although it is preferred that it is more than concealment thickness as for the thickness, even if it is less than it, if it is possible to conceal a ground by sum total thickness with a coat of the after-mentioned metallic paint (C), it will not interfere. Specifically, 5-25 micrometers of within the limits of 5-15 micrometers are [ especially thickness of a metallic paint (A) ] suitable on the basis of a cured film.

[0024]By this method (2), a clear coating (B) is painted to the painted surface, without painting a metallic paint (A) and stiffening the coat. Paint of a clear coating (B) is performed by an air spray, airless spray, electrostatic coating, etc., and, as for especially the thickness, 10-50 micrometers of within the limits of 15-35 micrometers are suitable on the basis of a cured film. After painting a metallic paint (A) and a clear coating (B), for example, it is 120-160 \*\* preferably, and 100-180 \*\* of both this coat is made to harden simultaneously by heating for 10 to 40 minutes.

[0025]After hardening both coats of a metallic paint (A) and a clear coating (B), this method (2) can be attained by painting a metallic paint (C) and a clear coating (D) further, and making both coats harden.

[0026]To the hardening painted surface of a clear coating (B), it is 5-13 micrometers (cured film) of thickness, and a metallic paint (C) is painted below by concealment thickness. Metallic paints (C) are base resin, a cross linking agent, metallic pigment, and a wet coating containing a solvent, and what was illustrated by this method (1) can use them conveniently. 10 to 20 % of the weight is [ especially solid content content of a metallic paint at the time of paint (C) ] suitable five to 25% of the weight. Even if concealment thickness of a metallic paint (C) is thicker than a metallic paint (A) used by the painting process, it does not interfere, and 10-20 micrometers 5-25-micrometer are especially suitable on the basis of a cured film.

[0027]In this method (2), thickness paints a metallic paint (C) to the hardening painted surface of a clear coating (B) by thickness below 5-13 micrometers (cured film) and concealment thickness. That is, it is required for thickness of a metallic paint (C) to be 8-11 micrometers (cured film) preferably, to space 5-13 micrometers of the coats and coats of a clear coating (B), and to be able to view the metallic painted surface of a metallic paint (A). Metal nonuniformity occurs that it will be hard to acquire uniform thickness distribution if thickness of a metallic paint (C) becomes thinner than 5 micrometers, Since F/F nature will moreover fall that it is easy to generate metal nonuniformity if it becomes thicker than 13 micrometers, and it will be easy to generate metal nonuniformity like the conventional two quart 1 baking method (2C1B) and F/F nature will moreover fall if it becomes thicker than concealment thickness, it is not desirable.

[0028]A clear coating (D) is a wet coating containing base resin, a cross linking agent, and a solvent, and forms a colorless or colored transparent coating film. Paint specifically same with having explained by this method (1) can use it conveniently. Solid content content of a clear coating at the time of paint (D) 40 to 60 % of the weight is especially suitable 30 to 60% of the weight.

[0029]This method (2) is attained by hardening both coats by metallic paint (C) and a clear coating (D), after painting and hardening a clear coating (B), painting a metallic paint (C) further and painting a clear coating (D) to the painted surface which is not hardened [ this ].

[0030]Paint of a clear coating (D) is performed by an air spray, airless spray, electrostatic coating, etc., and, as for especially the thickness, 20-60 micrometers of within the limits of 25-45 micrometers are suitable on the basis of a cured film. It is attained, when hardening is 120-160 °C and heats preferably 100-180 °C of both coats by metallic paint (C) and a clear coating (D) for 10 to 40 minutes, for example.

[0031]

[Effect of the Invention]1. Since a metallic paint (A) and a metallic paint (C) were recoated, and the coating film thickness of a metallic paint (C) was moreover 5-13 micrometers and it was below concealment thickness, generating of metallic nonuniformity was not viewed but it became possible to improve flip flop nature moreover. It became possible by making the coat of a clear coating (B) intervene between the layers of the coat of a metallic paint (A), and the coat of a metallic paint (C) to improve (this method 2) and flip flop nature more notably.

[0032]

[Example]Below, the example and comparative example about this invention are explained. Each of parts and % is based on weight, and the thickness of a coat is about a cured film.

[0033]1. Preparation metallic paint (A) of sample

(A-1): 75 copies of hydroxyl group content acrylic resins (the hydroxyl value 85, the acid value 5, number average molecular weight 10000), Mixture dispersion of 25 copies of butyl ether-ized melamine resin, 15 copies of aluminum flake pigments (the longitudinal method of 10-15 micrometers and 0.01-0.3 micrometer in thickness), and 0.1 copy of carbon black was carried out to the organic solvent, and the metallic paint was obtained. The solid content content of the metallic paint at the time of paint (A) is 14 % of the weight, and concealment thickness is 15 micrometers.

[0034]2) Clear coating (B)

(B-1): Mixture dispersion of 75 copies of hydroxyl group content acrylic resins (the hydroxyl value 100, the acid value 5, number average molecular weight 12000) and 25 copies of butyl ether-ized melamine resin was carried out to the organic solvent, and the clear coating was obtained. The solid content content of the clear coating at the time of paint (B) is 42 % of the weight.

[0035]3) Metallic paint (C)

(C-1): 75 copies of hydroxyl group content acrylic resins (the hydroxyl value 95, the acid value 5, number average molecular weight 10000), 25 copies of butyl ether-ized melamine resin, and aluminum flake pigment (the longitudinal method of 10-15 micrometers, and 0.01-0.3 micrometer in thickness) 15 Mixture dispersion of a part and 0.1 copy of carbon black was carried out to the organic solvent, and the metallic paint was obtained. Solid content content of the metallic paint at the time of paint (C) Concealment thickness is 15 micrometers 14% of the weight.

[0036]4) Clear coating (D)

(D-1): Mixture dispersion of 75 copies of hydroxyl group content acrylic resins (the hydroxyl value 100, the acid value 5, number average molecular weight 12000) and 25 copies of butyl ether-ized melamine resin was carried out to the organic solvent, and the clear coating was obtained. The solid content content of the clear coating at the time of paint (D) is 42 % of the weight.

[0037]An example and comparative example example A cationic electrodeposition paint and a polyester resin system intermediate coat are painted to the steel plate which performed 1 phosphoric-acid zinc processing, To the coated object which comes to carry out heat cure, a metallic paint (A-1) is painted so that it may become 8 micrometers of thickness with an air spray, After heating for 30 minutes and making it harden at 140 \*\*, a metallic paint (C-1) is painted so that it may become 8 micrometers of thickness with an air spray, After allowing to stand for 2 minutes at a room temperature, the clear coating (D-1) was painted so that it might become 35 micrometers of thickness with an air spray, and subsequently it heated for 30 minutes at 140 \*\*, and both this coat was made to harden simultaneously. The obtained metallic paint film was excellent in the metallic feeling without metallic nonuniformity, and, moreover, F/F nature was 1.88.

[0038]Example A cationic electrodeposition paint and a polyester resin system intermediate coat are painted to the steel plate which performed 2 phosphoric-acid zinc processing, To the coated object which comes to carry out heat cure, a metallic paint (A-1) is painted so that it may become 8 micrometers of thickness with an air spray, After allowing to stand for 2 minutes at a room temperature, a clear coating (C-1) is painted so that it may become 30 micrometers of thickness with an air spray, After heating at 140 \*\* for 30 minutes and making both coats harden, a metallic paint (C-1) is painted so that it may become 8 micrometers of thickness with an air spray, After allowing to stand for 2 minutes at a room temperature, it is thickness with an air spray about a clear coating (D-1). It painted so that it might be set to 35 micrometers, and subsequently it heated for 30 minutes at 140 \*\*, and both this coat was made to harden simultaneously. The obtained metallic paint film was excellent in the metallic feeling without metallic nonuniformity, and, moreover, F/F nature was 1.89.

[0039]Comparative example A cationic electrodeposition paint and a polyester resin system intermediate coat are painted to the steel plate which performed 1 phosphoric-acid zinc processing, To the coated object which comes to carry out heat cure, it is thickness with an air spray about a metallic paint (A-1). It paints so that it may be set to 16 micrometers, After heating for 30 minutes and making it harden at 140 \*\*, the clear coating (D-1) was painted so that it might become 35 micrometers of thickness with an air spray, and subsequently it heated for 30 minutes at 140 \*\*, and both this coat was made to harden simultaneously. Metallic nonuniformity occurred, the obtained metallic paint film was inferior in the metallic feeling, and, moreover, F/F nature was 1.71.

[0040]Comparative example A cationic electrodeposition paint and a polyester resin system intermediate coat are painted to the steel plate which performed 2 phosphoric-acid zinc processing, To the coated object which comes to carry out heat cure, a metallic paint (A-1) is painted so that it may become 16 micrometers of thickness with an air spray, After allowing to stand for 2 minutes at a room temperature, a clear coating (C-1) is painted so that it may become 30 micrometers of thickness with an air spray, After heating at 140 \*\* for 30 minutes and making both coats harden, it is thickness with an air spray about a clear coating (D-1). It painted so that it might be set to 35 micrometers, and subsequently it heated for 30 minutes at 140 \*\*, and this coat was made to harden simultaneously. Metallic nonuniformity occurred, the obtained metallic paint film was inferior in the metallic feeling, and, moreover, F/F nature was 1.71.

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